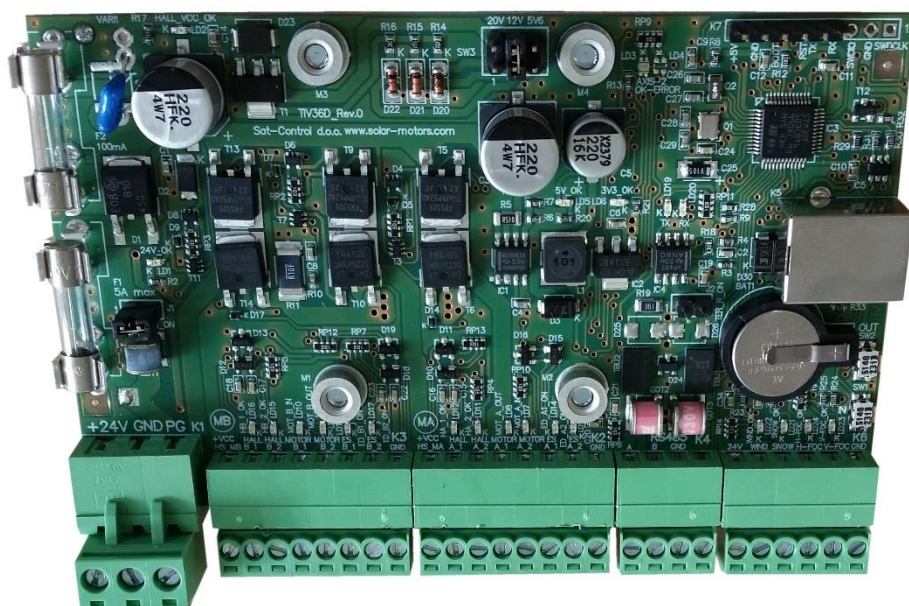


Want to get more?™

HELIOS ANALYTICS 2.0.9 for positioner MICRO, MICRO-D, TIV27C, TIV27E,  
TIV26A

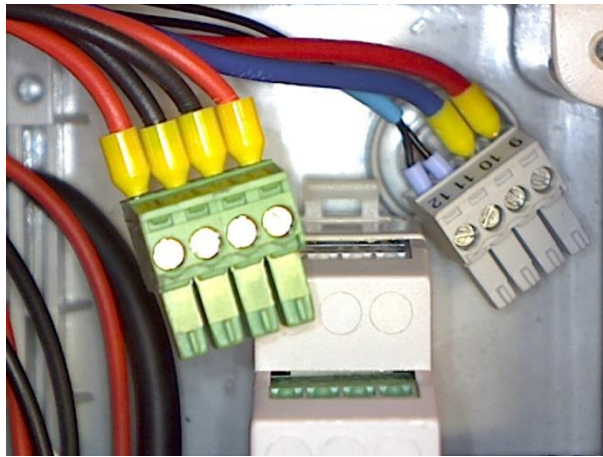
# User Manual Document Rev. 2.0.9 dated 15-05-2018



### **CONNECTING/DISCONNECTING of MICRO positioner:**

Colored connectors can be pulled out of positioner and plugged in, without screwing wires. Though we suggest you make sure that all screws are tied properly on all wires on both ends of cables (on motor side and on positioner side).

Be careful not to connect falsely as system might suffer damage.



### **BUTTONS:**

Positioner Micro has two black buttons, one runs Motor A towards retracted position (in) and the other button runs Motor A towards extended position (out).

Positioners POZSOL27x (OG+ trackers) also have buttons for manual operation with same function. One button runs Motor A towards starting point and the other runs motor towards ending position.

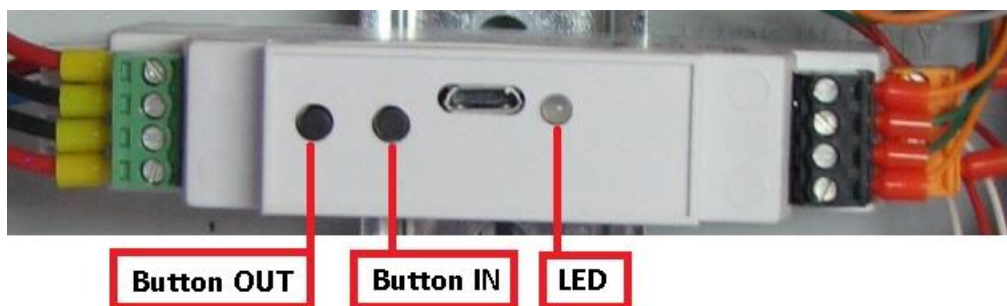
If you press both buttons at same time, red LED indicator will shine and manual operation will go into axis B mode, where one button runs Motor B in and the other button runs Motor B out. After few seconds of inactivity mode automatically goes into axis A mode.

If you keep both buttons pressed for ~15 seconds, tracking mode will be enabled (No manual time setup is available at Micro). At TIV27x positioner you can set up time and enable tracking by driving motor into most perpendicular position and holding both buttons ~15s.

Tipp: If tracking is enabled, motors will automatically return to sun-tracking position. If you wish the tracker to stay in position that was set manually, take transparent fuse out of the junction box or disconnect power supply.

### **Attention:**

- DO NOT run motors into retracted or extended position! Buttons are meant for testing and emergency use only.
- Note that all wiring is done before running motors!



### **HELIOS ANALYTICS:**

The basic tracker operation is not conditioned by the use of a PC, but it is necessary for first setup and it provides additional functions that can be useful for advanced users. In addition, different parameters of solar tracker can be seen in this menu.

### **CHANGING LANGUAGE:**

Language can be changed in drop down menu System, menu Settings. Available languages are English and German. Your language can be add as well, but you have to translate the texts into your language.





## ATTENTION!!

- Changing values in the menu may influence the solar tracker operation!
- If you encounter problems with tracker, go to Chapter 50: Troubleshooting.

Each white input field displays the current value, i.e., the solar tracker setting. Clicking in a particular input field turns the field **yellow** <sup>45.0</sup>, what means you can change the value. As long as the input field is yellow, you can enter a new value in it. When you are satisfied with the new value, press »Enter«. Entered value will be sent to positioner, input field will turn **white** again <sup>45.0</sup> and **new** (changed) value will be showed.

Some input fields meant as indicators so values and could not be changed (for example: supply voltage display). In such fields, changing value will not take effect.

**CONNECTION:** Positioner is connected to Helios via **USB bus** (default) or RS485 bus (optional). Use enclosed USB cable. After you connect to USB cable to your computer, let windows to install all drivers. The best when you have also internet there so you can let windows to install drivers from internet. Windows need to be updated to latest custom and security updates. In case this fail try with drivers which are described below.

Note: for RS485 you will need a RS485 dongle on the PC side, as PC does not have RS485 standard port. Please refer to additional paper. RS485 dongle is not a part of solar tracker and you need to buy additionally. RS485 dongle have their own driver to create virtual com port – VCP. RS485 driver you can download from this link: [http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/USB2RS485\\_Driver.zip](http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/USB2RS485_Driver.zip)



Sat Control d.o.o - Helios Analytics 2.0.9

File System Upgrade Support

Port: COM7 **Connect** Offline

Positioners Link: Version: Wind speed: km/h

Type: Service: Overvoltage occur:

Monitoring Advanced Sensors Options Loading

Overview

Mode: Sunrise (solar, local): Sun angle:

Voltage: V Sunset (solar, local): Sun elevation:

System settings

Solar h/m/s: GMT h/m/s: GMT d/m/y: Time zone: h DST Lon/Lat: Moving interval: s

Sync time ☒ Auto time zone setting

Last Sync time:

Tracker control

Automatic tracking: Enable Disable

H/V Alignment Snow

Wind Custom

Do reference A Do reference B

Stop motors Clear errors

Reset

Motor A

Angle: Position: Destination: Current of motor: A

Status: Error:

Motor B

Angle: Position: Destination: Current of motor: A

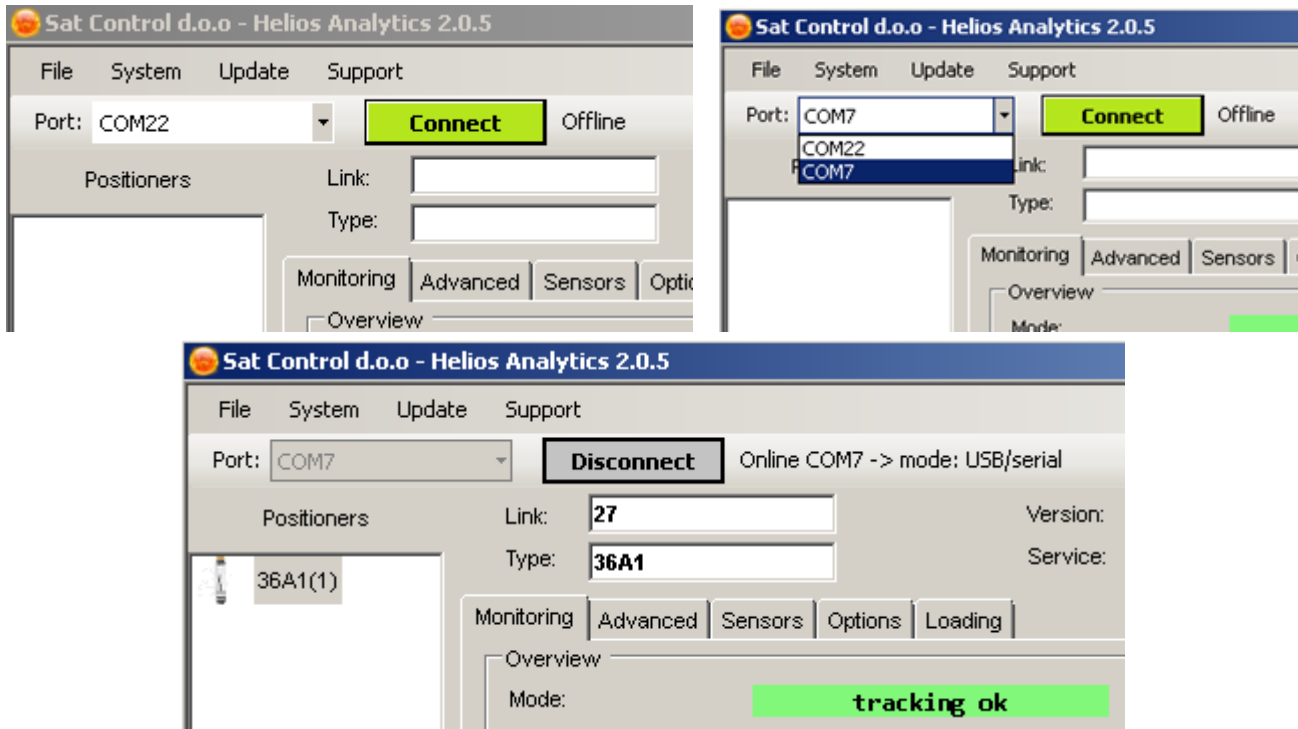
Status: Error:

Common

☐ Power failed ☐ Button pressed ☐ Button stuck ☐ A end switch pressed - low ☐ B end switch pressed - low ☐ A end switch pressed - high ☐ B end switch pressed - high ☐ A loosing hall pulses ☐ B loosing hall pulses ☐ A&B async

For manual moving with the buttons below, the automatic tracking must be disabled!

Directional buttons: Up, Down, Left, Right

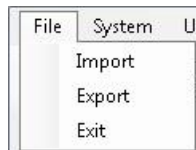


### Positioners

Big white space on the left is a space where all positioners on communication bus are shown. When on USB, only one positioner will show. When on RS485 bus, up to 32 positioners can be shown, which can be picked with click.

### Files dropdown menu

All values in fields can be **exported** into a file with extension "hss". It is useful to backup current settings. It is also possible to **import** values from saved "hss" file.



If you are unsure whether tracker's settings are correct, you can verify by simple maneuver:

- Check motor label and find parameter "Mech. version" (newer motors) or "MW ver" (older motors).  
Parameters at newer versions go from MC1 upwards (MC1, MC2, ...).  
Older versions are at separated by type (SM3, SM4S520M1, SM4S520M2, SM4S900M3) and those types have underclasses by number from 1000 upwards (1000, 1001, ...).
- **Applies to older version "MW ver."**: Basically, motors are the same with different markings. Translation table:  
<http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/Mechanical-versions-Translation-table.pdf>
- Find correct parameters in table Mechanical gears and common parameters:  
[http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/Mechanical\\_gears\\_and\\_common\\_parameters.pdf](http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/Mechanical_gears_and_common_parameters.pdf)
- Both tables are available under tab Support: <http://www.solar-kit.com/tracker-solaire/suiveur-solaire/support>
- Another option is to verify motor's "Mech. Version" or "MW ver" and import suitable \*.hss file in Helios analytics, which are available under tab Support: <http://www.solar-kit.com/tracker-solaire/suiveur-solaire/support>

## System dropdown menu

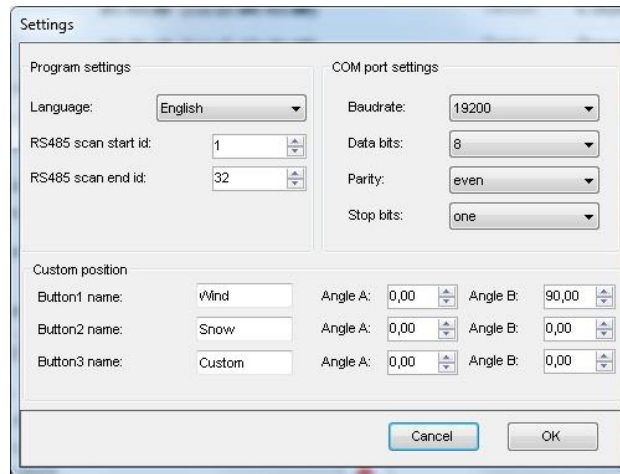
Menu includes two submenus: **Settings** and **Locking**.

Submenu Settings includes parameters "Program settings" box, "COM port settings" box and "Custom position" box.

Under "Program settings" Language and scan of RS485 IDs can be changed.

Under "COM port settings" communication properties for RS485 bus can be changed (already pre-set).

Under "Custom position" angle of three buttons in Helios Analytics main menu can be changed. Clicking on a button disables tracking and forces the position. See details in chapter 19.



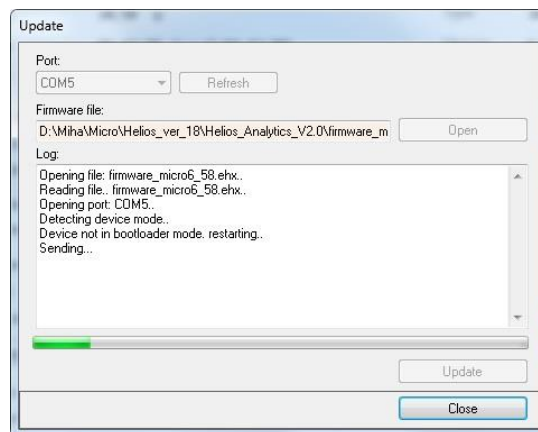
Submenu Locking is not relevant for regular users.

## Update

Driving electronic (firmware) in solar tracker is upgradable. It means that we constantly improve the program, which is running in your product. Check for latest version on our web site <http://www.solar-kit.com/tracker-solaire/suiveur-solaire/support>. If newer version exists, download and save zip file to your local disk. Unzip the file to a known location.

### Update via Helios Analytics

In Helios analytics program select menu Update, select correct COM port, browse for latest downloaded upgradable file (\*.ehx) and press Update. Wait until transfer reaches 100% and click "Close". If update is successful, new number of FW version will be shown. After upgrade procedure make sure to replace all "-nan" fields with "0" (Zero), if you don't know the appropriate value. "-nan" fields can cause the system to malfunction. If update is not successful, update the positioner manually.



**Note:** Described feature is available only for versions "B1" and higher. Lower versions need to be updated manually. See upgrading manuals below. Manual update is possible on new versions, too.

### Manuals for old boot loader releases:

- **PC side:** you must have the following files:
    - "app\_36\_ver5.41.ehx" or suntracrer.ehx" (see note 1),
    - "app\_36\_ver5.41.bat" (see note 1) and
    - "update.exe".
- Save them all in same folder, i.e. c:\your\_folder\

- **Solar tracker controller side:**  
Disconnect all power supplies from your controller. Press "W" button (button to run motor OUT) and connect your solar tracker controller to a PC (on USB port) with USB cable, which was included by solar tracker (orange LED must light). Then release the button and orange LED will be flashing (time limited to 1 minute).
- **PC side:** While LED is still flashing, click on "app\_36c\_ver5.41.bat" file. You will be asked for used COM port (you can see it in device manager), insert it and press enter. Transfer will begin, LED will turn off.
- At 100% upgrade is finished.

Do you have problems with upgrading?

Refer to [http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/Problems\\_with\\_upgrading\\_solutions.pdf](http://www.solar-kit.com/WebRoot/StoreLFR/Shops/62035995/MediaGallery/Helios/Problems_with_upgrading_solutions.pdf) **Note 1:** name.ehx or name.bat could be different. Described is just an example.

## Support

Link to USB drivers page and Information window with our contact information.

## COM port

Before getting any data from solar tracker, select correct **COM port** and click button

**Connect**

To disconnect, click button

**Disconnect**

Port:

COM7

**Connect**

**Note:** you need to have USB (VCP) driver installed. Drivers are included in the archive file.

## Monitoring tab

Sat Control d.o.o - Helios Analytics 2.0.9

File System Upgrade Support

Port: COM7 **Disconnect** Online COM7 -> mode: USB/serial

Positioners: 36D1(1)

Link: 21 Version: 6.67 (B1) Wind speed: 0.0 km/h

Type: 36D1 Service: Run:normal,Wi=0,Si=0 Overvoltage occur: 0

Monitoring Advanced Sensors Options Loading

Overview

Mode: **tracking ok** Sunrise (solar, local): 04:31:15 (Local:05:31:15) Sun angle: -12.43°(PM), -27.00°(AE)

Voltage: 25.84 V Sunset (solar, local): 19:22:10 (Local:20:22:10) Sun elevation: 64.37°(PM), 61.71°(AE)

System settings

Solar h/m/s: 11 : 03 : 46

Solar d/m/y: 15 / 05 / 2018

GMT h/m/s: 10 : 03 : 46

GMT d/m/y: 15 / 05 / 2018

Time zone: 1.0 h ☒ DST

Lon/Lat: 15.0000 ° 45.0000 °

Moving interval: 300 s

**Sync time** ☒ Auto time zone setting

Last Sync time: 15/05/2018 08:48:52

Tracker control

Automatic tracking: **Enable**

H/V Alignment **Show**

Wind **Custom**

Do reference A **Do reference B**

Stop motors **Clear errors**

**Reset**

Motor A

Angle: -14.5 °

Position: 82773 i

Destination: 82773 i

Current of motor: 0.00 A

Status: **Idle**

Error: **OK**

Motor B

Angle: 64.5 °

Position: 67632 i

Destination: 67632 i

Current of motor: 0.00 A

Status: **Idle**

Error: **OK**

Common

☐ Power failed

☐ Button pressed

☐ Button stuck

☐ A end switch pressed - low

☐ B end switch pressed - low

☐ A end switch pressed - high

☐ B end switch pressed - high

☐ A loosing hall pulses

☐ B loosing hall pulses

☐ A&B async

For manual moving with the buttons below, the automatic tracking must be disabled!

Manual movement controls: Up, Down, Left, Right arrows.

## Link

Indicates communication status. If the value is incrementing, Helios has a stable connection to Solar tracker. Otherwise check cables, re-plug USB cable and restart Helios Analytics.

## SunTracer type

Is type of electronic module inside the tracker. You will be asked after it when contacting our service team.

#### SunTracer Version

Is version of program running inside the positioner. This parameter will change after upgrade.

#### Service

Field shows service data, errors, mode etc..

#### Wind speed

Field shows value of the measuring wind speed. It is doubled field from Sensors tab.

#### Overvoltage occure

Field shows value of overvoltage detection counter.

#### Voltage

Current supply voltage connected to solar tracker.

#### Sunrise (solar, local)

Shows solar and local time of sunrise for current day.

#### Sunset (solar, local)

Shows solar and local time of sunset for current day.

#### Sun angle

Shows current PM hour angle and AE azimuth.

#### Sun elevation

Shows PM and AE elevation.

#### Time

Current SOLAR time for your location (see geo. longitude/latitude). Note that solar time could differ from your zone time. It is correct only for your accurate geo longitude. The range for hours is 0-23, and minutes 0-59. Hint: if you set geo. longitude to 0.0, time must completely equal with GMT time.

#### Day/month/Year

Current date. Range of days is 1-31, months 1-12, of years 1970<.

#### Time zone

**Time zone** and **DST**: Parameters "Time zone" and "DST" (daylight saving time) applies to Sunrise and Sunset indication and has no effect on actual tracking.

If the **Auto time zone setting** is selected, Time zone and DST are placed automatically according to the current time zone set on your system.

#### Longitude, latitude

Indicate your geographical longitude and latitude (important for solar time calculation). Negative longitude values go western from Greenwich, negative latitude values go southern from equator (southern hemisphere).

#### Moving interval

Means at what interval the solar tracker will correct its position to trace the sun. Possible values are from 60 to 900 seconds (1-15 minutes). If you check option "Resolution 0.1 degree" possible values are 1 ~ 900 seconds.

#### »Sync time« button

Pressing the »Sync time« button automatically sets the current time and date. If your time or date is incorrect (more than ten minutes), press the »Sync« button to open a wizard where you insert your local Longitude. Application automatically downloads GMT time from your computer and writes it in the solar tracker memory. Last time synchronization showing sings **Last Sync Time**. Synchronizing time cause a correction factor **RTC correction** or **Soft. RTC Correction** (visible in the Advanced tab).

**Note:** The mean solar time used by the solar tracker is set for your geographical longitude, and differs from your zone time. Therefore do not change it after synchronizing.

#### Enable, disable buttons

**Enable** button enables tracking, **Disable** button disables tracking.



### H/V alignment button

Pressing this button causes solar tracker to move in complete horizontal position. This is necessary during mechanically setup the tracker to align correct angles.

H/V Alignment

Pre-set angles are: motor A = 0° and motor B = 90.0°. If panels (or mirror,...etc) are not in horizontal position after motor were stopped and some minor shift appear, you need to adjust mechanically (screws, clamps) to get proper horizontal position. For completely horizontal position, take spirit level as a sufficient measuring device.

### Snow button

Pressing this button automatic tracking will become **disabled** and tracker will turn the panel into snow position.

### Wind button

Pressing this button automatic tracking will become **disabled** and tracker will turn the panel into wind position.

### Custom position buttons

These are predefined buttons with predefined angles. You can use them, for example, emergency park position in strong wind or high snow parking position for cleaning it from the panels or your custom park position. Pressing any of these buttons automatic tracking will become **disabled** and tracker will turn the panel into desired position. You can **define** all three buttons on your own: navigate to "System" and press "Settings". Change text, angle A and angle B. See chapter 2.

### »Do reference A/B« buttons

Use buttons to synchronize motors. In case of any change between real axes position and internal counters (impulses) or after mechanic/electronic service synchronization needs to be done. After pressing each button, motors run to its reference position (home). When motors stop, positioner is synchronized with actual motors position.

**Attention:** If system is not synchronized when in tracking mode, motors could suffer severe damage!

By clicking *Do reference A/B*, errors will be cleared automatically.

Do reference A

Do reference B

### Stop motors button

Pressing this button stops the engine unconditionally.

### Clear errors button

By pressing this button, all errors that have been detected and are no longer current are erased.

### Reset button

By pressing this button, the positioner is restarted.

### Angle A, B

Parameters show current angle for each tracker axis. Angle A usually means hour angle and angle B elevation. Hour angle has negative values in the morning and positive values in the afternoon. If you want to set tracker to specific angle, disable tracking, insert number into space "Angle" (in degrees) and press enter.

### Position, destination (A/B)

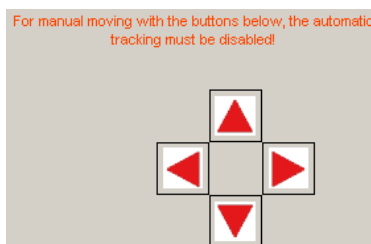
Parameters show current and destination and position in impulses. Those values can only be used to diagnose the solar tracker operation.

### Current of motor, A,B

Show current of each motor at that moment.

### Manual movements with buttons

With 4 red buttons you can manually move both axes. If you wish to move axes manually by arrows or inserting angle, Automatic tracking must be disabled.



Parameter "**Mode**" indicates current status of tracker:

- » **tracking ok** « - automatic tracking enabled, the Sun is above the horizon, tracking is possible (according to mechanical range)
- » **sun too far** « - automatic tracking enabled, Sun is unreachable
- » **night mode** « - automatic tracking enabled, during the night

» **tracking disabled** « - automatic tracking disabled

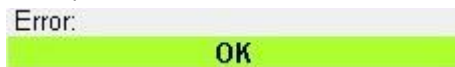
### Status (A/B)

Indicate a current operating status of tracker ("← moving in", etc.)

### Error (A/B)

Indicates that an error occurred when tracking.

If status shows an error and you have already solved the problem, click on "Clear" to enable motors again.



- **overcurrent:** motor's high current exceeds limitation setting
- **hall:** position feedback sensor signal failed
- **too long ref:** going to reference is too long
- **cable:** bad connection between motors and positioner
- **end switch pressed:** the motor is stopped due to the end switch pressed (low or high end switches)
- **stopped by overvoltage:** the motor is stopped due to overvoltage occur

### Common

Box indicates warnings and actions that tracker is performing.

- **Power failed:** this flag is set after each power fault (use Clear errors button)
- **Button pressed:** when the button on positioner is pressed the box is checked
- **Button stuck:** button is being pressed for longer time and is probably stuck
- **A/B end switch pressed - low:** motor is at the lowest end – reference position
- **A end switch pressed - high:** motor A is at the highest end. The field is used when the stop & clear input and wind secondary input options are not selected (tab options).
- **B end switch pressed - high:** motor B is at the highest end. The field is used when "Go to reference" input and snow secondary input options are not selected (tab options).
- **Stop & Clear input(7):** When pin 7 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the stop & clear input option is selected (tab options).
- **"Go to reference" input (6):** When pin 6 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the "Go to reference" input option is selected (tab options).
- **Wind secondary input (7):** When pin 7 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the wind secondary input option is selected (tab options).
- **Snow secondary input (6):** When pin 6 on orange plug is connected to GND, flag appears. For more information see title *Options tab*, chapter 42. The field is used when the snow secondary input option is selected (tab options).
- **A/B losing hall impulses:** position feedback sensor signal on specific Motor does not match the actual one.
- **A&B async:** Only in synchronous run mode. If »A-B asynch.diff« value is set and actual difference between A and B exceed this value the flag appears and the motors stop.

## Advanced tab

### Coordinate mode

Means which coordinate system astronomic equations are used. Generally used is Azimuth-Elevation system (AE), other less known is Polar-Mount system (PM).

**Note:** If you are using our tracker, parameters are already set.

Coordinate m.	1	2	3	4	5	6	7	8	11	
Geometry m.										
<b>1</b>	X	X					X	X	X	Slew drive azimuth, elevation tracking(coordinate 11 azimuth only [Deviation=0°])
<b>2</b>	X		X		X		X	X	X	Azimuth / Hour angle tracking (coordinate 11 Deviation=0°)
<b>3</b>		X		X		X	X	X		Elevation tracking
<b>11</b>									X	Slew drive Elevation tracking (Deviation =90°)
<b>13</b>									X	Elevation tracking (Deviation =90°)

Coordinate modes 5 for Hour angle and 6 for Elevation angle is used in Heliostats. For tracker to operate as heliostat, check "Heliostat" under tab Options and define parameter "Target" under tab Advanced parameters.

Coordinate modes 7 (Azimuth) and 8 (Elevation) are used in mixed motor systems, when one motor is slew drive and another linear one.

When geometry modes 11 and 13 are in use, tracker's horizontal position is 0° and vertical position is 90° (opposite of other geometries).

### Geometries

Different trackers have different geometries. Geometry includes parameters **A1-A6, B1, B2** and number of selected geometry **geometry mode**.

**Note:**

- ♦ If you are using **our tracker**, parameters are already set. **Do not change anything.**
- ♦ If you have **your own** tracker, see Geometry document available on our web page or contact our technical support.
- ♦ If Geometry mode is 0, axis is **not in use** (disabled). It will not be controlled.
- ♦ Geometry mode parameters are fixed by purchasing conditions. Contact our sales team to add additional geometries.

**Motor A/B – Coordinate mode 11**

Coordinate mode 11 is calculating best trajectory for one-axis trackers. Whether trackers are Azimuth / Hour angle / Elevation based, correct Geometry mode should be picked.

Parameters are used for anti-shadowing function:

- **Deviation** (Azimuth / Hour angle only): fixes physical deviation, when tracker is not pointed directly to south at 0° (Rotation parallel with earth, refer to page 20; scheme *Coordinate mode 11* – angle Beta)
- **Slope of terrain** (Elevation only): Useful for powerplants - modifies anti-shadowing regarding terrain angle (Rotation perpendicular to earth, refer to page 20; scheme *Coordinate mode 11* – angle Alpha)
- **Panel width (anti-shadowing function)**: Width of full tracker surface
- **Panel spacing (anti-shadowing function)**: Distance between trackers pillars
- **Panel safety width (anti-shadowing function)**: Panel thickness

**Moving properties**

Positioner measures motor movement with hall incremental encoder. **Max range** defines maximum permitted impulses, at which motor will stop. Above, motor will be hard stopped. The same goes for **min range** limit. Relation between impulses and degrees (slew drives) or millimeters (linear motors) is defined by gear ratio. **Gear ratio** is counted number of impulses by positioner per one degree or one millimeter.

**Note:** In case of using our tracker, parameters are already set.

**Inrush current ratio, Inrush current time**

**Inrush current time** defines for how many milliseconds current higher than "Max motor current" is allowed. It is limited to "Max motor current" multiplied with "**Inrush current ratio**". This setting is useful in cold weather when motors consume more current in startup.

By default it is set to our motors specifications:

**Inrush current ratio = 2.5 to 3**

**Inrush current time = 500-700 ms**

**Note** that those parameters will take effect in positioners "Micro" with firmware 6.40 or higher and in positioners "TIV27x" with firmware 6.58 or higher.

**Day mode time (Versions 6.57 and lower)**

Is the time, when tracker starts tracking. Until then it waits in the night position. It can be set between 1:00 and 12:00.

**Night mode time (Versions 6.57 and lower)**

Is the time, when tracker stops tracking and goes to night position. It can be set between 14:00 and 23:00.

**Sunrise offset (Versions 6.58 and higher)**

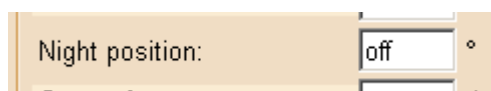
As there is no more Night mode time, sunrise can be delayed or sped up.

**Sunset offset (Versions 6.58 and higher)**

As there is no more Day mode time, sunset can be delayed or sped up.

**Night position**

Is the position in degrees where the tracker will be parked during the night (between Sunset and Sunrise). You can disable night position with typing **off** in this window. This cause that the motor A or B with disabled night position will not move to night position and it will stay at last position driven before sunset or at last manually turned position. You can disable only motor A or motor B, both or none. If you disable B motor, you save one cycle of lifetime of motor each day. For example: By the tracker with 2 linear motors model ST44M3V15Por ST44M2VxP, the night position for motor B can be disabled, because the position of the elevation at sunset is practically same as the position of sunrise. This way the motor at night is not moving anywhere and save lifetime of motor.

**SN1,2,3**

Are serial numbers of solar tracker positioning module.

**RS485 Id**

Is ID number for RS485 bus. The tracker will respond only to this number.

**Note:** changing ID during use of RS485 mode can cause communication to be lost. Set proper ID via USB.

## Voltage factor and Current factor

Are voltage and current measuring factors. Those values are pre-set.

## RTC correction, Soft. RTC correction

Applies to real time clock divergence. If time is faster or slower than real solar time (expected difference is less than a minute per month), then you can set this value to correct this divergence. Value means add or subtract inserted seconds per a day.

Checked on parameter "RTC Software" at the options TAB means that when 24V power is present shall run "Soft. RTC correction" but when 24V power is not present, the "RTC correction".

## Synchronous mode

Applies when both motors are supposed to run parallel into a specific direction (useful when one controlling unit is used to control two 1-axis trackers). The value is maximal permitted difference (impulses).

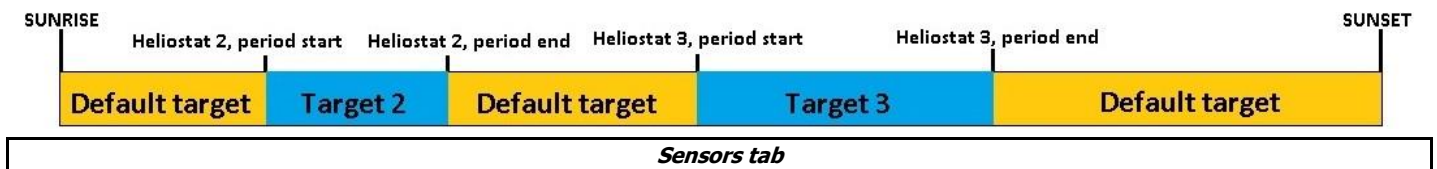
## H/V default target angle

Applies to Heliostats only. Parameters define horizontal and vertical angle at which solar tracker sees the target. Target is the point in a front of the tracker, where you want to have a spot. Positive angles are up from the horizon (vertical direction) and west from the south (horizontal direction). Negative are below the horizon (vertical direction) and east from the south (horizontal direction).

**Note:** For tracker to operate as Heliostat, check "Heliostat" in Options tab and set correct "Coordinate mode" in Advanced parameters tab.

## H/V target angle 2/3, Heliostat period 2/3 start/end

If you desire separate targets in different slices of the day, insert target angle and starting and ending time of day's period.



Under tab Sensors focus, wind, snow sensor and over temperature sensors are configured. Sensors are enabled in the "Options" tab.

The screenshot shows the 'Sensors' tab configuration interface. It is divided into four main sections: Focus, Wind, Snow, and Overtemperature.

- Focus:** Includes input fields for Sensor output A (0000), Sensor output B (0041), Middle A (1180), Middle B (1180), Max offset +/- (-nan), Offset A (0.0), and Offset B (0.0).
- Wind:** Includes input fields for Wind speed (0.0 km/h), Speed threshold (40.0 km/h), Fall time (30 min), Wind safe angle A (0 °), Wind safe angle B (90 °), and Conv. factor (0.900 (km/h)/h).
- Snow:** Includes input fields for Snow clear angle A (0 °) and Snow clear angle B (20 °).
- Overtemperature:** Includes input fields for Overtemp. shift angle A&B (-nan °) and Overtemp. shift time out (-nan min).

## Focus

Solar Optical sensor function is enabled under tab Options.

Solar Optical sensor or Focus sensor is fine-tuning-only sensor to eliminate mechanical tolerances made by installation and therefore tracker achieves better accuracy. It is essential for concentrator applications. Sensor outputs are direct misalignment readouts for both axis. Expected values are from 0 to app 2000 (@24VDC powering). According to the "Middle" values, offsets are incremented or decremented slowly to get sensor output values more or less equal to middle values. Offsets will be added to the tracker's angles.

When parameter "Focus sensor in use" is checked, new parameter will appear in "Service" line under tab Monitor: "F:seek" or "F:avg". In clear weather system checks every minute how much is it out of focus and adapts Offset in such manner. "F:seek" will appear in Service line.

Service: Run:normal,Wi=0,Si=0,F:seek

In the meantime it averages tracking trajectory with latest offset. "F:avg" will appear in service line.

Service: Run:normal,Wi=0,Si=0,F:avg

Maximum offset parameter defines at which angle deviation the system will still find sun focus. When using Solar optical sensor for the first time, make sure weather is clear. Set parameter Max offset to "10.0" and observe what is maximum angle deviation in the morning and in the evening (**Offset A/B**). Then insert maximum angle deviation into parameter Max offset, increased by 1.0 (if maximum deviation through day was 2.4°, set it to 3.4°).

When weather is not completely clear the sensor cannot function properly and without "Low sun radiation sensor" tracker goes into previously set Maximum offset negative position. If you have Low sun radiation sensor installed (pin diode with switch, which pulls to GND when radiation is low), system detects it and tracks with last Offset A/B. "F:avg" will appear in Service line.



Low radiation sensor should be plugged into orange connector, pin No. 7 (previously A\_end\_switch\_2). Low radiation sensor should pull down to GND when triggered.

## Wind

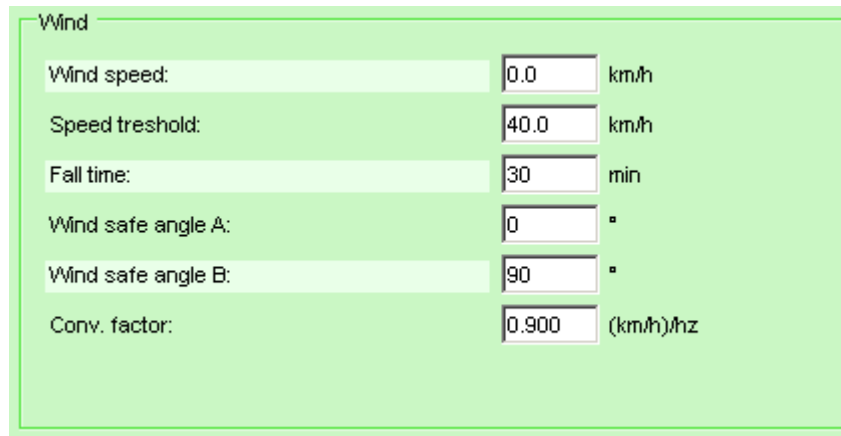
Wind sensor feature is enabled under tab Options.

If the wind is strong it can damage the tracker. Therefore it is suitable to move panels into **wind save angle A/ B** (usually in completely horizontal position), when the wind speed exceeds **speed threshold** for the first time. After getting to wind save position, positioner will wait **fall time** long until going back to normal operation. If wind speed exceeds the speed threshold again, a new fall time period must be waited.

**Wind speed** is output data of the measuring wind speed. **Conversion factor** is factor of wind sensor meaning how much speed causes 1 revolution per second (at impulse types) or how much speed causes 1 volt. Sensor must be of **impulse** type – with no additional resistor by the reed switch (not current loop 4-20mA impulses output type).

**Attention:** There are two different wind sensor types on market, provided by SAT CONTROL. Older version with "Conv. Factor" = 1.22 and wired on 2 wires (until December 2013) and new version (from January 2014) with "Conv. Factor" = 2.44 and wired on 3 wires. New version also includes a label with parameter "Conv. Factor" and older version does not (blank).

**Hint:** You can enable wind mode on one axis only by setting the "Wind safe angle" of other axis to off.



The screenshot shows a configuration window titled "Wind" with a light green background. It contains several input fields and labels:

Parameter	Value	Unit
Wind speed:	0.0	km/h
Speed threshold:	40.0	km/h
Fall time:	30	min
Wind safe angle A:	0	°
Wind safe angle B:	90	°
Conv. factor:	0.900	(km/h)/hHz

Wind mode is turned off on axis A

## Snow

Snow function can be enabled under tab Options. When Snow sensor is enabled, Overtemperature shift is disabled.

When snow sensor is activated, the tracker will move into **snow clean angle A and B** so snow slides down (normally in nearly vertical position). If wind mode is activated, snow mode will be **disabled**.

## Over temperature shift

Over temperature shift is enabled under tab Options. When Over temperature shift is enabled, Snow sensor is disabled.

In some applications it is necessary to shift panel out of ideal position to lower the temperature. Tracking is still enabled but shifted for an **Over temperature shift A and B** angle. When temperature drops the sensor is being switched off and the tracker will go into normal tracking after the **Over temp shift time out** runs out.

### Configuration options flags

Sensor flags are available for the user. Here you can turn on external sensors: focus sensor, wind sensor, snow sensor. Other flags refer to mechanical configuration for which the motor was made. Some flags are mechanically depended and are not meant to be changed by user (Axis flags).

**Motor A / B speed** can be set to **slow** or **very slow** for motors with a lower number of hall pulses in one motor turn.

### Options

Show which additional features and functions are available. Those features are free of charge and are included by default.

**Note:** For tracker to operate as Heliostat, define its target in "H/V target angle" and set correct "Coordinate mode" in Advanced parameters tab.

- **Secondary communication bus:** by selecting this this option also allows CAN communication in addition to USB.
- **Resolution 0.1 degree:** by selecting this option is used for the accuracy of moving 0.1 degrees. The minimum setting of the **moving interval** (tab Monitoring) can be set to 5 seconds, otherwise 60 seconds.
- **Heliostat**  
Checked box mean that heliostat mode is allowed, but this does not mean that will automatically work as a heliostat mode. When you want to switch on the heliostat mode you need to setup the coordinate mode motor A to 5 and coordinate mode motor B to 6. Beside of this you need to setup the resolution 0.1 degree, time interval to 20 seconds and setup the at least default target or more targets and more periods.
- **"Go to reference" input (6)** enables external triggering of sending motors into reference. When pin 6 on orange plug (MICRO 2) / pin 7 [ES B2] on plug K3 [motor-B] (MICRO-D) is connected to GND (on falling edge) , motors will search reference point. For more information see title *Monitor tab*, chapter 20.
- **Snow secondary input (6)** enables triggering "Snow sensor function" and "Overtemperature shift function" at external pin 6 on orange plug (MICRO 2) / pin 7 [ES B2] on plug K3 [motor-B] (MICRO-D) instead on *Internal connection (sensors)*. Handy if you are missing grey-flat-6-pin cable with red connector.  
If box is unchecked, functions are triggered from *Internal connection (sensors)*. Refer to Wiring scheme in chapter 51 *Supplement*. Function is defined in box **Check: Snow sensor in use / Uncheck: Overtemperature shift** under *Configuration Flags*.
- **Stop & Clear input (7)** enables the system to stop all motors by external button and clear any possible errors.
- **Wind secondary input (7)** enables Wind sensor reading at external pin 7 on orange plug (MICRO 2) / pin 7 [ES A2] on plug K2 [motor A] (MICRO-D) instead on *Internal connection (sensors)*. Handy if you are missing grey-flat-6-pin cable with red connector.  
If box is unchecked, wind speed is being read from *Internal connection (sensors)*. Refer to Wiring scheme in chapter 51 *Supplement*. Wind mode is enabled in box **Wind sensor in use** under *Configuration flags*.

Secondary communication bus

- ☒ Resolution 0.1 degree
- ☒ Heliostat
- ☐ "Go to reference" input(6)

Inrush current ration:	3.0	Inrush current ration:	3.0
Inrush current time:	700 ms	Inrush current time:	700 ms
Coordinate mode:	5	Coordinate mode:	6
Geometry mode:	2	Geometry mode:	3
Motor factor:	1000	Motor factor:	1000
RTC correction:	-105 s	RTC correction:	-105 s
Soft. RTC correction:	0 s	Soft. RTC correction:	0 s
H default target angle:	-5.0 °	H default target angle:	-5.0 °
V default target angle:	33.0 °	V default target angle:	33.0 °
H target angle 2:	Off °	H target angle 2:	Off °
V target angle 2:	Off °	V target angle 2:	Off °
H target angle 3:	Off °	H target angle 3:	Off °
V target angle 3:	Off °	V target angle 3:	Off °
Heliostat 2. period start:	00:00	Heliostat 2. period start:	00:00
Heliostat 2. period end:	00:00	Heliostat 2. period end:	00:00
Heliostat 3. period start:	00:00	Heliostat 3. period start:	00:00
Heliostat 3. period end:	00:00	Heliostat 3. period end:	00:00

Time zone: 1.0 h

Lon/Lat: 15.0000 ° 37.0000 °

Moving interval: 20 s

Sync time

### Troubleshooting

#### • USB driver is not recognized:

- Turn off UAC (User Account Control):  
[https://www.google.si/search?q=how+to+turn+off+uac&og=how+to+turn+off+uac&ags=chrome..69i57j69i61j0l4.3175j0j9&so=urceid=chrome&espv=210&es\\_sm=93&ie=UTF-8](https://www.google.si/search?q=how+to+turn+off+uac&og=how+to+turn+off+uac&ags=chrome..69i57j69i61j0l4.3175j0j9&so=urceid=chrome&espv=210&es_sm=93&ie=UTF-8)

#### • USB device is not recognized *or* Device is recognized as false communication type:

- Plug it into different USB jack
- If positioner is recognized as RS485 when using USB communication, check if cable/plug/jack etc. is damaged. Pick different USB jack.
- If positioner is recognized as USB when using RS485 communication, one of wires might be loose.

#### • Positioner's voltage or motor's current consumption is shown incorrectly:

- Verify (with voltmeter) that voltage is 24V on white plug, No. 9 and 10.
- If you can measure voltage/current correctly, check parameters »U supply factor« and »I motor factor«.
- »U supply factor« @Micro = 115      »U supply factor« @TIV27x/TIV26 = 64
- »I motor factor« @Micro/TIV27x/TIV26 = 80

#### • Motor does not move:

- **Positioner or motor smells burned or is smoking:** Disconnect it from power supply immediately. CAUTION: Be very careful as equipment can be very hot! Wait one minute after disconnecting before touching it. Take positioner out of housing and visually inspect the damage. Send a photo of burned area to support with request of evaluation whether positioner can be repaired.
- Axis is already in error. Open Helios analytics, verify the error and try to remove it by yourself. When you are done resolving, click »Clear« to clear the error.
- Positioner has no connection to motor and cannot move. »A/B Cable« error will soon erupt. Check that ALL cables are tied into plugs on both sides of cable (on positioner and on motor side) and clear error.
- In case problem is still present, disable tracking and switch cables of motors (Cable A ↔ Cable B).
  - If the problem remains on same axis cable (and different motor), there is still no connection on cable or there is a problem on positioner. Disconnect system from power and disconnect motor cable. Measure conductivity of every single wire with Ohm-meter when bending/twisting the cable!
  - If problem switched to another axis cable (but on the same motor), motor itself is at fault.

#### • Motor stops after half a second: Motor draws more current than it is defined in parameter »I motor Max«. »Overcurrent« error will soon erupt. Refer to chapter 26 and to online table »Mechanical gears and Common parameters«, additionally to table »Translation Table for Mechanical versions (Older to Newer)«. Both are available on <http://www.solar-kit.com/tracker-solaire/suiveur-solaire/support>

• **Motor stops after 3 seconds:** Position feedback sensor signal is failing. »Motor A/B losing hall impulses« flag is already present, »Hall A/B« error will soon erupt.

- Check that ALL cables are tied into plugs on both sides of cable (at positioner and at motor).
- In case problem is still present, switch cables on motors (Cable A ↔ Cable B).
  - If the problem remains on same axis (and different motor), there is still no connection on cable or there is a problem on positioner. Disconnect system from power and disconnect motor cable. Verify conductivity of every single wire with Ohm-meter when bending/twisting the cable!
  - If problem switched to another axis (but on the same motor), motor itself is at fault.

• **Tracker has false position:**

- One of motors already stopped. Refer to troubleshooting options above and to Chapter 26: Errors.
- Motors have lost its reference or it was not set up at all. Disable tracking and click »Do reference A« and »Do reference B«.
- Time, Date or parameters Latitude and Longitude are set up false.
  - Set parameters correctly
  - Replace inner battery and set parameters

• **Source of problem is not obvious or cannot be discovered:**

- Make sure that **NO** field is filled with »-nan« parameter. If you don't know the value, insert »0« (Zero). "-nan" fields can cause the system to malfunction.
- Download latest Helios Analytics and update positioner firmware. Helios Analytics is available on <http://www.solar-kit.com/tracker-solaire/suiveur-solaire/Logiciel-de-pilotage-Helios>

**When all options of troubleshooting are exhausted, contact support for help with detailed description of problem, Tracker type and motors type (copy »MW ver.« or »Mech. Version« from motor label). Also attach screen shots of all tabs from Helios Analytics.**

## Loading MC for motors and in advance ready Geometries

Sat Control d.o.o - Helios Analytics 2.0.9

File System Upgrade Support

Port: COM7 Disconnect Online COM7 -> mode: USB/serial

Positioners Link: 27 Version: 6.67 (B1) Wind speed: 0.0 km/h

Type: 36D1 Service: Run:normal,Wf=0,Si=0 Overvoltage occure: 0

Monitoring Advanced Sensors Options Loading

Motor configuration

Loading motors from file: C:\Users\Dev1\Desktop\Nova mapa (7)\HeliosAnalytics2\motors.txt

Load configuration motor A: select configuration Load

Load configuration motor B: select configuration Load

Geometry configuration

Loading geometries from file: C:\Users\Dev1\Desktop\Nova mapa (7)\HeliosAnalytics2\geometries.txt

Load geometry properties for motor A: select configuration Load

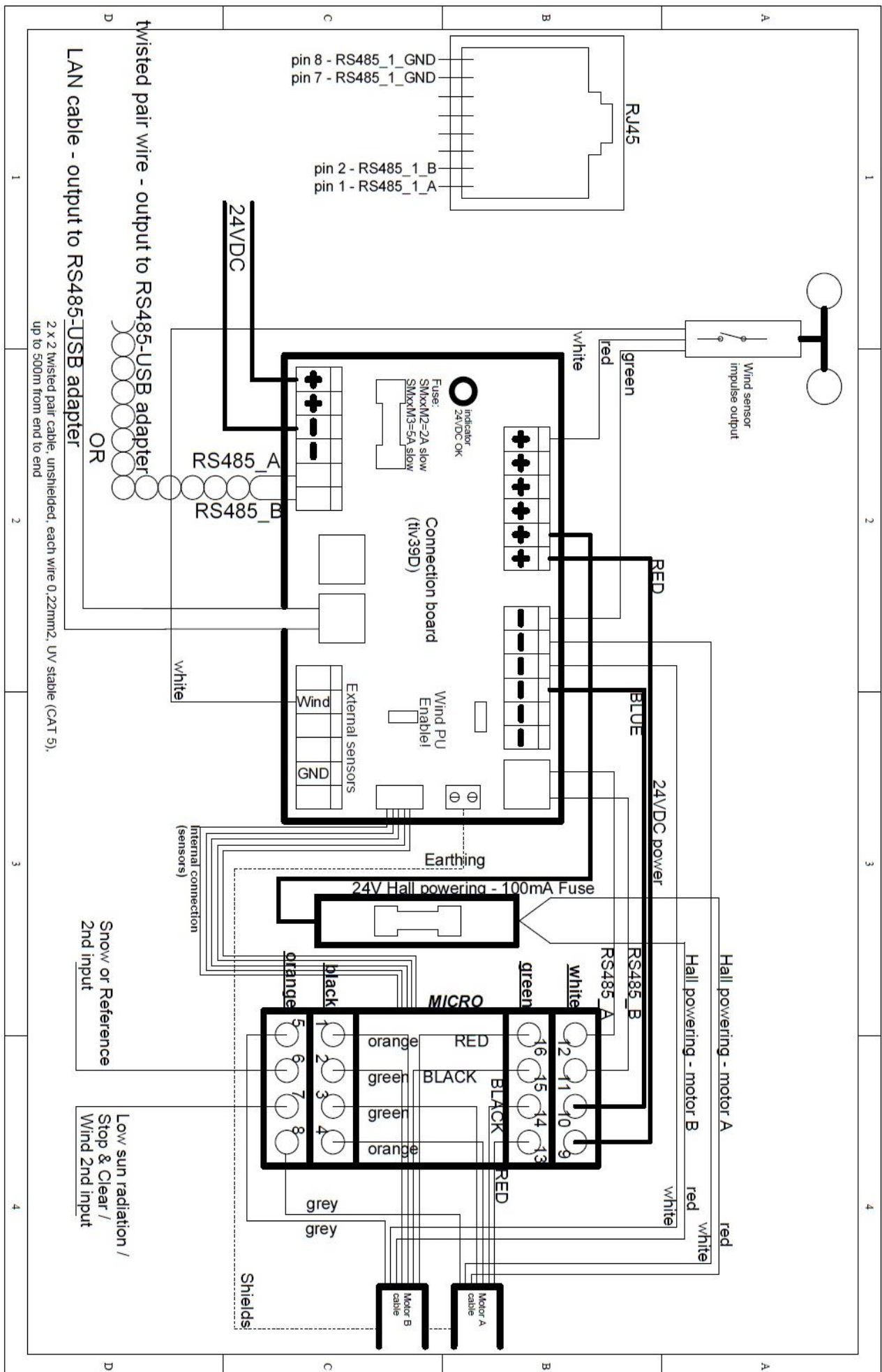
Load geometry properties for motor B: select configuration Load

When you want to change the geometry you can choose from dropbox menu and load to selected A or B motor.

When you want to change the configuration setting for motor you can choose from dropbox menu appropriate MC and load to selected A or B motor.



Wiring scheme:

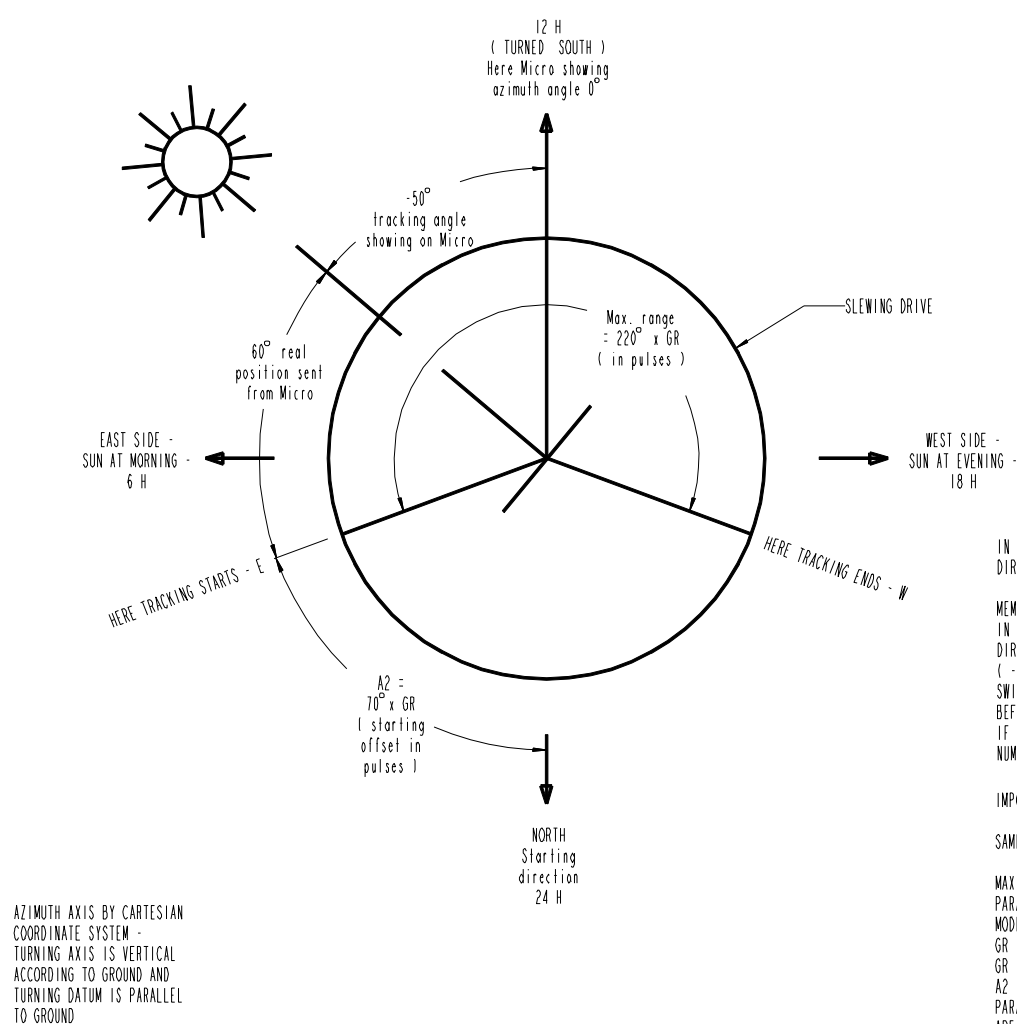




CONN	PN	FUNCTION (TYPE OF OUTPUT / INPUT AND VOLTAGE)	WIRE AND COLOR
	PN		
	K1		
	PN 1 =	+24VDC5A (INPUT)	RED WIRE MN 4.0 MM2
	PN 2 =	MINUS - GND (INPUT)	BLUE WIRE MN 4.0 MM2
	PN 3 =	PG-EARTHING (INPUT)	YELLOW-GREEN WIRE 4.0 MM2
	K3		
	PN 1 =	+30VDC (OUTPUT) HALL SENSOR MOTOR B	RED WIRE 0.25 MM2
	PN 2 =	HALL SENSOR MOTOR B, 1 (DIGITAL INPUT 024VDC)	ORANGE WIRE 0.25 MM2
	PN 3 =	HALL SENSOR MOTOR B, 2 (DIGITAL INPUT 024VDC)	GREEN WIRE 0.25 MM2
	PN 4 =	MOTOR B, 1 (DIGITAL OUTPUT 024VDC)	RED WIRE 1.0 MM2
	PN 5 =	MOTOR B, 2 (DIGITAL OUTPUT 024VDC)	BLACK WIRE 1.0 MM2
	PN 6 =	END SWITCH B, 1 (DIGITAL INPUT 024VDC)	GREY WIRE 0.25 MM2
	PN 7 =	END SWITCH B, 2 (DIGITAL INPUT 024VDC)	
	PN 8 =	(GND) MINUS (OUTPUT) HALL SENSOR MOTOR B,	WHITE WIRE 0.25 MM2
	PN 8	AND CABLE SHIELDING (OUTPUT)	COPPER SHIELDING
	K2		
	PN 1 =	+30VDC (OUTPUT) HALL SENSOR MOTOR A	RED WIRE 0.25 MM2
	PN 2 =	HALL SENSOR MOTOR A, 1 (DIGITAL INPUT 024VDC)	ORANGE WIRE 0.25 MM2
	PN 3 =	HALL SENSOR MOTOR A, 2 (DIGITAL INPUT 024VDC)	GREEN WIRE 0.25 MM2
	PN 4 =	MOTOR A, 1 (DIGITAL OUTPUT 024VDC)	RED WIRE 1.0 MM2
	PN 5 =	MOTOR A, 2 (DIGITAL OUTPUT 024VDC)	BLACK WIRE 1.0 MM2
	PN 6 =	END SWITCH A, 1 (DIGITAL INPUT 024VDC)	GREY WIRE 0.25 MM2
	PN 7 =	END SWITCH A, 2 (DIGITAL INPUT 024VDC)	
	PN 8 =	(GND) MINUS (OUTPUT) HALL SENSOR MOTOR A,	WHITE WIRE 0.25 MM2
	PN 8	AND CABLE SHIELDING (OUTPUT)	BLACK - COPPER SHIELDING
	K4		
	PN 1 =	RS-485 A (INPUT-OUTPUT DIGITAL 05VDC)	BROWN WIRE FROM TWISTED PAIR 0.5 MM2
	PN 2 =	RS-485 B (INPUT-OUTPUT DIGITAL 05VDC)	WHITE WIRE FROM TWISTED PAIR 0.5 MM2
	PN 3 =	GND - MINUS (OUTPUT)	YELLOW-GREEN WIRE FROM TWISTED PAIR 0.5 MM2
	PN 4 =	SHIELDING - (OUTPUT)	BLACK - COPPER SHIELDING
	K6		
	PN 1 =	+30VDC (OUTPUT)	RED WIRE 0.25 MM2 (2X)
	PN 2 =	MINUS SENSOR (DIGITAL INPUT 024VDC)	WHITE WIRE 0.25 MM2
	PN 3 =	SNOW SENSOR (DIGITAL INPUT 024VDC)	YELLOW WIRE 0.25 MM2
	PN 4 =	HORIZONTAL FOCUS SENSOR (ANALOG INPUT 024VDC)	WHITE WIRE 0.25 MM2
	PN 5 =	VERTICAL FOCUS SENSOR (ANALOG INPUT 024VDC)	YELLOW WIRE 0.25 MM2
	PN 6 =	GND - MINUS (OUTPUT)	GREEN WIRE 0.25 MM2 (2X)

ALL PRE-WIRED ASSEMBLY IS CONNECTED SO, IF YOU DO NOT ORDER ALL OPTIONS IS PRE-WIRED ONLY.

# GEOMETRY 1 FOR CMI for MICRO positioner



AZIMUTH AXIS BY CARTESIAN  
COORDINATE SYSTEM -  
TURNING AXIS IS VERTICAL  
ACCORDING TO GROUND AND  
TURNING DATUM IS PARALLEL  
TO GROUND

- COORDINATE MODES OR CM
- 1 - AZIMUTH TURNING IN CARTESIAN COORDINATE SYSTEM - CM1
- 2 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM2
- 3 - HOUR ANGLE TURNING IN POLAR COORDINATE SYSTEM - CM3
- 4 - ELEVATION TURNING IN POLAR COORDINATE SYSTEM - CM4

- COORDINATE MODE A = 1
- GEOMETRY MODE A = 1
- GEAR RATIO A = 131,6 imp/°
- MAX RANGE A = 28952 imp ( for 220° )



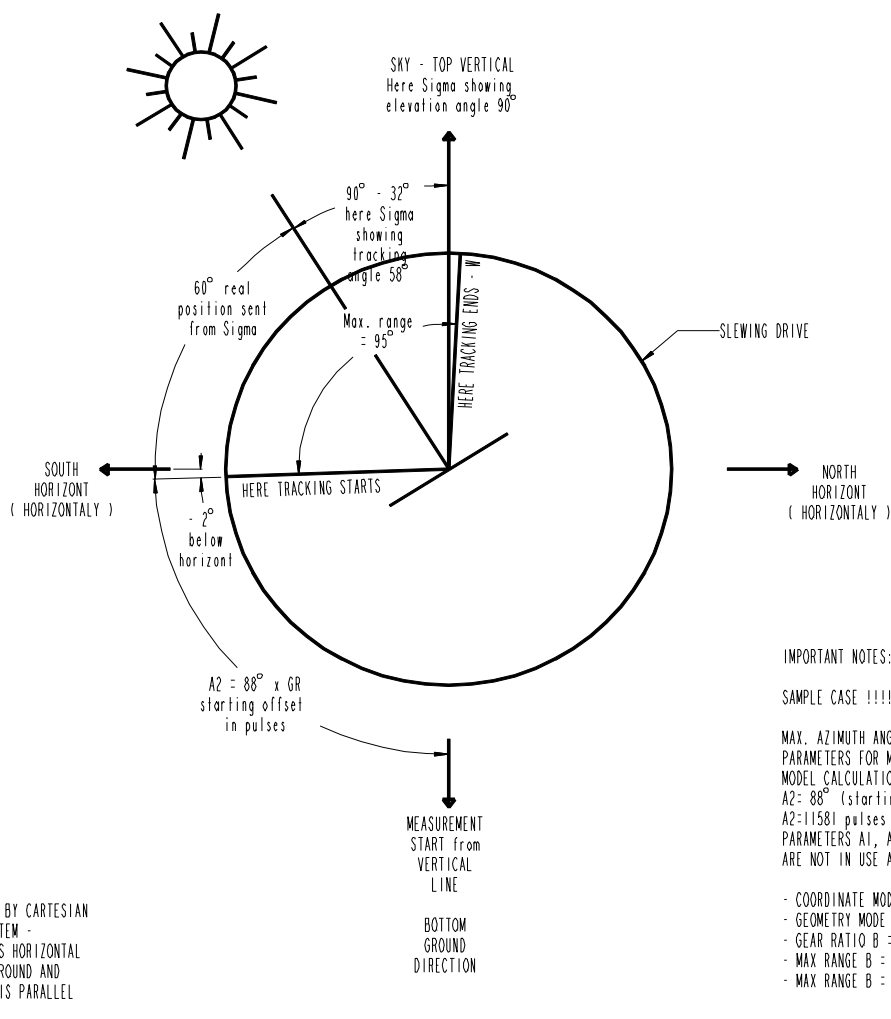
Description: Geometry model sketch 1 for Azimuth axis of solar tracker and coordinate mode 1

File: GEO\_MODEL\_1\_FOR\_AZIMUTH.CMI.MIC / GEO\_MODEL\_1\_FOR\_AZIMUTH.CMI.MIC

Latest version:  
V1

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www.solar-motors.com

# GEOMETRY 1 for CM2 & CM4 by MICRO POSITIONER and SLEWING DRIVE installed as ELEVATION AXIS



- COORDINATE MODES - CM
- 1 - AZIMUTH TURNING IN CARTESIAN COORDINATE SYSTEM - CM1
- 2 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM2
- 3 - HOUR ANGLE TURNING IN POLAR COORDINATE SYSTEM - CM3
- 4 - ELEVATION TURNING IN POLAR COORDINATE SYSTEM - CM4



Description: Geo. model sketch 1 for elevation axis of solar tracker for CM2 or CM4 in MICRO

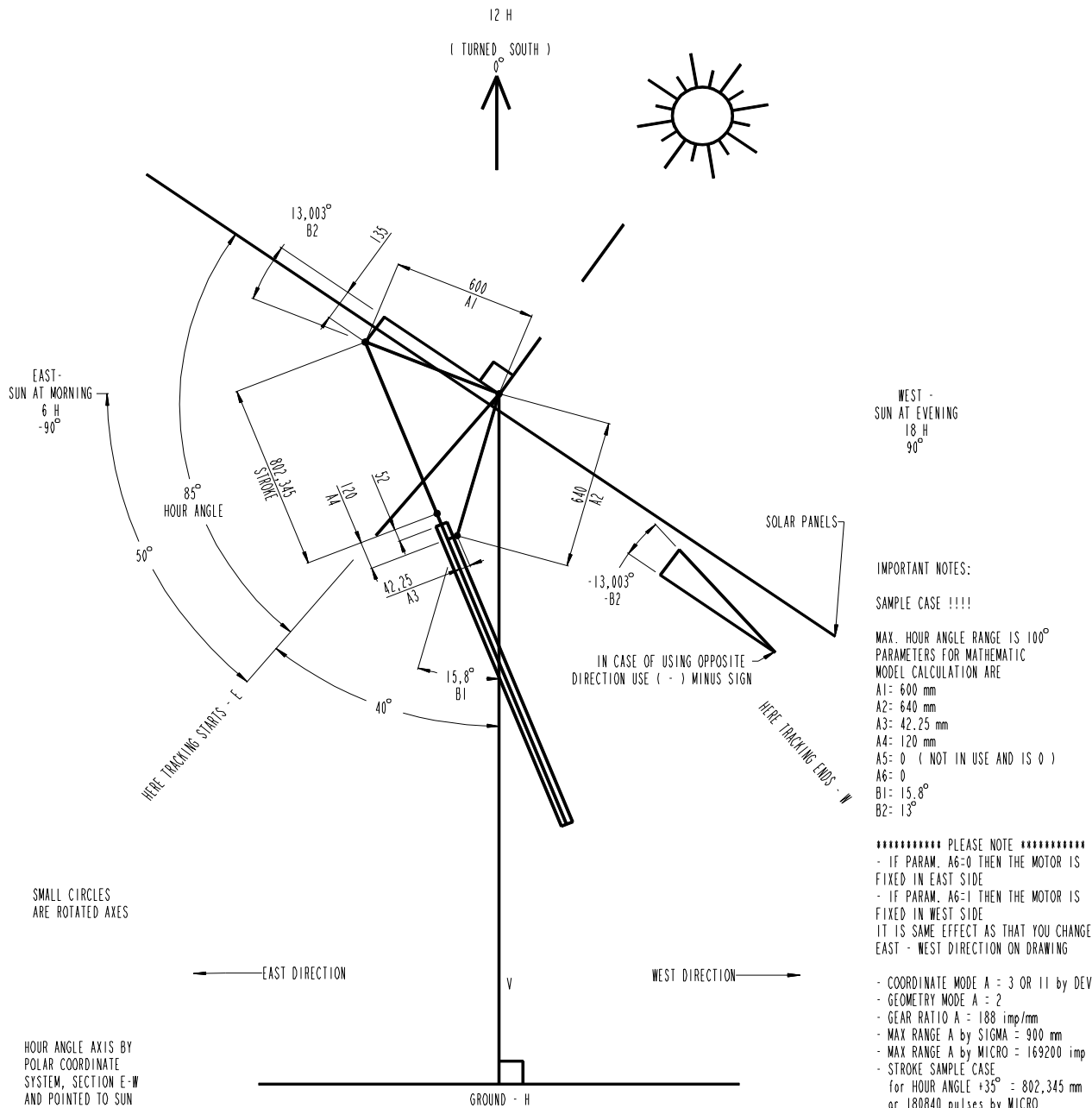
File: GEO.MODEL\_1.FOR.ELEV.CM2-4.MIC / GEO.MODEL\_1.FOR.ELEV.CM2-4.MIC

Latest version:  
V1

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Hour Angle (Geometry 2 for Coordinate mode 3):

# GEOMETRY 2 FOR CM3 OR CM11 ( BY DEVIATION 0° )



## IMPORTANT NOTES:

SAMPLE CASE !!!!

MAX. HOUR ANGLE RANGE IS 100°  
PARAMETERS FOR MATHEMATIC  
MODEL CALCULATION ARE  
A1: 600 mm  
A2: 640 mm  
A3: 42.25 mm  
A4: 120 mm  
A5: 0 ( NOT IN USE AND IS 0 )  
A6: 0  
B1: 15.8°  
B2: 13°

\*\*\*\*\* PLEASE NOTE \*\*\*\*\*  
- IF PARAM. A6=0 THEN THE MOTOR IS  
FIXED IN EAST SIDE  
- IF PARAM. A6=1 THEN THE MOTOR IS  
FIXED IN WEST SIDE  
IT IS SAME EFFECT AS THAT YOU CHANGE  
EAST - WEST DIRECTION ON DRAWING

- COORDINATE MODE A = 3 OR 11 BY DEVIATION 0°  
- GEOMETRY MODE A = 2  
- GEAR RATIO A = 188 imp/mm  
- MAX RANGE A by SIGMA = 900 mm  
- MAX RANGE A by MICRO = 169200 imp  
- STROKE SAMPLE CASE  
for HOUR ANGLE +35° = 802,345 mm  
or 180840 pulses by MICRO

\*\*\*\*\* PLEASE NOTE \*\*\*\*\*

HOUR ANGLE = -90° : TURNED TO EAST  
HOUR ANGLE = 0° : TURNED TO SOUTH  
HOUR ANGLE = 90° : TURNED TO WEST

HOUR ANGLE AXIS BY  
POLAR COORDINATE  
SYSTEM, SECTION E-W  
AND POINTED TO SUN

- COORDINATE MODES -----> CM
- 1 - AZIMUTH TURNING IN CARTESIAN COORDINATE SYSTEM - CM1
- 2 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM2
- 3 - HOUR ANGLE TURNING IN POLAR COORDINATE SYSTEM - CM3
- 4 - ELEVATION TURNING IN POLAR COORDINATE SYSTEM - CM4
- 11 - ELEVATION TURNING IN CARTESIAN COORDINATE SYSTEM - CM11  
BY DEVIATION 90°
- 11 - HOUR ANGLE TURNING IN CARTESIAN COORDINATE SYSTEM - CM11  
BY DEVIATION 0°

## IMPORTANT NOTE !

Sigma solar server is operating only with angle degrees and mm !  
MICRO positioner is operating with angle degrees, mm and is showing always pulses !



Description: Geo. model sketch 2 for Hour angle axis of solar Tracker at CM3 or CM11 by DEV. 0

File: GEOMETRY\_MODEL\_2\_FOR\_HAM\_CM3 / GEOMETRY\_MODEL\_2\_FOR\_HAM\_CM3

latest version: Copyright Sat Control d.o.o.  
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# Elevation (Geometry 3 for Coordinate modes 2 and 4):

